Original Article

MEDICINE PALLIATIVE CARE

DOI: 10.47582/jompac.1327960

J Med Palliat Care. 2023;4(4):350-354

The effect of occupational therapy on upper extremity function and activities of daily living in hemiplegic patients

Ayşe Gülşen Doğan

Department of Physical Medicine and Rehabilitation, Erol Olçok Training and Research Hospital, Hitit University, Çorum, Turkey

Cite this article as: Doğan AG. The effect of occupational therapy on upper extremity function and activities of daily living in hemiplegic patients. *J Med Palliat Care*. 2023;4(4):350-354.

Received: 15.07.2023 ◆ **Accepted**: 28.08.2023 ◆ **Published**: 30.08.2023

ABSTRACT

Aims: We aimed to investigate the effectiveness of occupational therapy (OT) added to traditional rehabilitation treatments on activities of daily living and upper extremity functions in hemiplegic patients in this study.

Methods: This study was carried out within eighty hemiplegic patients. In the evaluation of the patients before the therapy, age, gender, body mass index (BMI), occupation, education, duration of stroke, stroke etiology, symptomatic side, the presence of systemic diseases and dominant hand data were recorded. The patients were randomized into two groups according to the sealed envelope method. While standard rehabilitation (ST) (50 minutes five days a week for 6 weeks) was applied to the first group, ST (50 minutes five days a week for 6 weeks) and OT (40 minutes three days a week for 6 weeks) were applied to the second group. Functional Independence Scale (FIM), Fugl-Meyer Upper Extremity Assessment of Motor Recovery Scale (FMA) and Action Research Arm Test (ARAT) were evaluated before the treatment and on the 45th day after the end of the treatment.

Results: Our study included 35 male and 45 female patients. There was no significant difference between the two groups in terms of age, gender, symptom duration and stroke etiology. FIM, ARAT and FMA values were found to be increased in both groups compared to pre-treatment (ST; FIM p=0.003, ARAT p=0.011, FMA p= 0.002 OT; FIM p=0.023, ARAT p=0.024, FMA p= 0.012). While there was no significant difference in terms of FIM, ARAT and FMA values before treatment in comparisons between groups, all parameters were found to be significantly increased in the OT group compared to ST on the 45th day of treatment (FIM p=0.017, ARAT p=0.021, FMA p= 0. 004).

Conclusion: In this study, OT was applied three times a week for 40 extremity dexterity. While the increase in FIM, FMA and ARAT was significant after treatment in both groups, the increase in the OT group was higher when compared to ST. The results of our study show that both ST and OT are effective in stroke rehabilitation. In addition, it has been clearly proven that more effective results are obtained in upper extremity functions with OT added to ST.

Keywords: Hemiplegia, occupational therapy, upper limb

INTRODUCTION

Stroke is a clinical syndrome with symptoms lasting 24 hours or longer, with no obvious cause other than vascular origin and often with focal deterioration in cerebral functions.[1] Stroke is a serious neurological disease and over the last two decades there has been an increase in deaths from stroke by 43%.[2,3] Despite the advances in stroke prevention and treatment, it is an important health problem that affects a large part of the society with its high incidence and mortality and causes disability in survivors. Post-stroke disability reduces the patient's quality of life, affects the lives of patients' relatives and causes both socioeconomic and social problems.[4] Only 10% of post-stroke patients show complete recovery and 60% suffer from chronic dysfunction.[5] Upper limb function after stroke is the main cause of long-term disability so rehabilitation research is a top priority. Although nerve reorganization occurs soon after stroke, the natural rehabilitation of upper limb function recovery is usually limited.[6] Upper limb paresis is observed in 87% of stroke survivors.[7] Furthermore, impaired use of the upper limb persists in about 60% of the patients 6 months post-stroke.[8] Early exercise interventions are necessary to improve upper extremity motor functions and activities of daily living (ADL), as persistent upper extremity dysfunction is strongly associated with decreased activities of daily living and poor quality of life after stroke.[9-11]

Occupational therapy (OT) is a part of medical rehabilitation therapy aimed at restoring, strengthening and increasing the person's performance in specified activities and tasks in order to improve health, reduce and correct pathology.[4] Studies have shown that OT shortens the length of hospital stay, increases activities

Corresponding Author: Ayşe Gülşen Doğan, drmdagu@gmail.com

This work is licensed under a Creative Commons Attribution 4.0 International License.

of daily living, and increases the level of independence in stroke patients.[12,13] Although the incidence of ischemic and hemorrhagic strokes is high worldwide annually, the optimal dose and timing for OT are entirely unclear.

Stroke remains one of the leading causes of death and disability in world, and projections show that the burden of stroke will not decrease in the next decade or beyond.[14] After a stroke, one of the main sequelae produced is the loss of mobility in the upper extremities of the human body. Therefore, in the assessment of upper extremity function it's important to improve the effectiveness of rehabilitation programs, and the use of standardized outcome measures which can lead to more efficient rehabilitation programs for post-stroke patients.[15] Therefore, we aimed to investigate the effectiveness of OT added to traditional rehabilitation treatments on activities of daily living and upper extremity functions in hemiplegic patients in this study.

METHODS

Sixty patients with hemiplegia who applied to Erol Olçok Training and Research Hospital Physical Medicine and Rehabilitation Clinic were included in the study. The study was approved by the Hitit University Clinical Researches Ethics Committee (Date: 24.05.2023, Decision No: 2023-67). A well-informed written consent was obtained from all participants according to the principles of the Declaration of Helsinki. The inclusion criteria were 18-75 years of age, diagnosed with stroke for the first time, not more than 12 months after stroke and no cognitive dysfunction. Exclusion criteria were aphasic patients, the presence of flaccid hemiplegia, the presence of spasticity above grade 3 in the upper extremity according to the Modified Ashworth Scale (MAS) and the absence of sitting balance. In the evaluation of the patients before the therapy, age, gender, body mass index (BMI), occupation, education, duration of stroke, symptomatic side, the presence of systemic diseases and dominant hand data were recorded. All patients underwent detailed neuromuscular system examination before treatment and at controls. The patients were randomized into two groups according to the sealed envelope method. While standard rehabilitation (ST) (50 minutes five days a week) was applied to the first group, ST (50 minutes five days a week) and OT (40 minutes three days a week) were applied to the second group. Conventional rehabilitation exercises such as passive, active and active-assisted range of motion, strengthening, balance coordination exercises, transfer training exercises, walking and climbing stairs were applied to the patients in the ST group, accompanied by a physiotherapist. A trained occupational therapist performed OT. The treatment balls, colored cylinders, perforated circles, wooden blocks, skill house and skill cubes were used during the treatment.

Parametres

All parameters were evaluated before the treatment and on the 45th day after the end of the treatment.

Functional independence measures (FIM) : The FIM includes measures of independence for self-care. It is an 18-item, seven-level, ordinal scale. The total score (sum of motor and cognition subscale scores) for the FIM tool will be a value between 18 and 126.[16]

Fugl-Meyer upper extremity assessment of motor recovery scale (FMA): It is a subsection of the Fugl Meyer Rating Scale. This scale, which includes 33 items, evaluates the movement, coordination and reflexes of the shoulder, elbow, forearm, wrist and fingers. In the scale with a maximum score of 66, it is scored as "0: movement cannot be performed", "1: movement is partially performed" and "2: movement is performed normally", except for items including reflex activity and coordination and speed assessment.[17]

Action research arm test: It is a responsive and valid measure of upper limb functional limitation and is a useful measure for use in upper limb rehabilitation and clinical research. It has 4 subgroups measuring gross, fine, and fingertip grip and coarse motion and 19 evaluation items. The upper extremity motor function assessment was done in the current study by scoring each item in the following order as 0: cannot do movement, 1: does (completes) movement partially, 2: does the movement with difficulty in an abnormally long time, and 3: does the movement normally (with no difficulty).[18]

Statistical Analysis

Analyzes were made with the SPSS 23.0 program. Descriptive statistics are presented with frequency, percentage, mean, standard deviation, median, minimum and maximum values. Non-parametric data were analyzed using the Wilcoxon signed ranks test to investigate within-group differences; a paired sample t-test was applied to compare intragroup changes of normally distributed variables. Independent t-tests were performed to compare the means between the groups for normally distributed data, while MannWhitney U test was utilized for non-parametric variables without normal distribution. The nominal variables were examined by the Pearson Chi-square test or Fisher's Exact test. The results were assessed within 95% reliance and at a significance level of $p<0.05$.

RESULTS

Our study included 35 (43.75%) male and 45 (56.25%) female patients. The mean age of the patients was 67.03±8.96 years. There were 40 patients in both groups and the majority of patients were women. There was no

significant difference between the two groups in terms of age, gender, symptom duration and stroke etiology (Table 1). FIM, ARAT and FMA values were found to be increased in both groups compared to pre-treatment (ST; FIM p=0.003, ARAT p=0.011, FMA p= 0.002 OT; FIM p=0.023, ARAT p=0.024, FMA p= 0.012) (Table 2). While there was no significant difference in terms of FIM, ARAT and FMA values before treatment in comparisons between groups, all parameters were found to be significantly increased in the OT group compared to ST on the 45th day of treatment (FIM p=0.017, ARAT p=0.021, FMA p= 0. 004) (Table 3).

Table 1. Demographic and clinical characteristics of the treatment groups

	ST group (n=40)	OT group (n=40)	p value
Age (Mean±SD)	67,8 ± 4,9	66,8 ± 4,2	0.088
Gender (F/M)	23/17	22/18	0.613
Dominant extremity (right/left)	34/6	36/4	0.173
Symptom Duration (month)	9.12±1.23	9.45±1.45	0.256
Stroke etiology Ischemic/haemorrhagic	32/8	34/6	0.453

ST: Standard treatment, OT: Occupational therapy, F/M: Female/Male, SD: Standart Deviation

Table 2. Comparison of ARAT, FIM and FMA on values of ST and OT groups in two stages

	Before treatment Mean±SD	45th day after treatment Mean±SD	p value
ST group			
FIM	72.11± 14.3	83.16± 15.8	0.003
ARAT	48.73±11.6	52.31±11.4	0.011
FMA	53.21±12.8	58.72±12.5	0.002
OT group			
FIM	73.18±16.9	90.3±15.7	0.023
ARAT	48.36±10.4	54.71±11.03	0.024
FMA	51.4±13.01	61.73±13.5	0.012

ST: Standard treatment, OT: Occupational therapy FIM: Functional Independence Scale, FMA:Fugl-Meyer Upper Extremity Assessment of Motor Recovery Scale, ARAT: Action Research Arm Test

Table 3. Comparison of ARAT, FIM and FMA scores of the patients before the treatment, and at the 45th day of the treatment between groups

		ST Mean±SD	OT Mean±SD	p value
FIM	Before treatment	72.11± 14.3	73.18±16.9	0.162
	45th day of treatment	83.16± 15.8	90.3±15.7	0.017
ARAT	Before treatment	48.73±11.6	48.36±10.4	0.075
	45th day of treatment	52.31±11.4	54.71±11.03	0.021
FMA	Before treatment	53.21±12.8	51.4±13.01	0.237
	45th day of treatment	58.72±12.5	61.73±13.5	0.004

SD: Standart Deviation, ST: Standard treatment, OT: Occupational therapy FIM: Functional Independence Scale, FMA:Fugl-Meyer Upper Extremity Assessment of Motor Recovery Scale, ARAT: Action Research Arm Test

DISCUSSION

The results of our study show that OT added to traditional rehabilitation treatments improves the upper extremity functions and increases independence levels in hemiplegic patients. Although ARAT, FIM and FMA values were found to be increased in the groups receiving ST and OT treatment added to ST, compared to pretreatment, this increase was found to be more significant in the OT group compared to the ST group. Ageing is regarded as the most important predictor of stroke incidence and mortality, and thus, their rates increase by age. 88% of global strokes occur above age 65 years.[19] The mean age of the patients was 67.03±8.96 years ın our study. Ischemic stroke is the most common type of stroke, accounting for about 80% stroke.[20] The majority of the patients in our study had a history of ischemic stroke. In an epidemiological study conducted in our country, it was reported that 54.3% of strokes were seen in women.[21] Similar to the literature, female patients were more common than males in our study. Motor and sensory disorders in the upper extremity limit the daily life activities of the person and increase the rate of dependence on others more than the disability in the lower extremities. In stroke rehabilitation, rehabilitation of the upper extremity is important in order to gain independence in daily living activities.[22] Although studies have been reported showing that OT has positive results in the acquisition of new motor skills in the upper extremity, there is no consensus in the literature on the duration of OT application. In the study of Aydilek et al.[4] on 48 patients with hemiplegia, two treatment groups were compared. The patients in the first group were treated with standard rehabilitation (5 days for 6 weeks, 45 minutes a day) plus OT (5 days for 6 weeks, 45 minutes a day), while the patients in the second group were applied only standard rehabilitation. In the results of the 6th week after the treatment; It was observed that there was a statistically significant increase in the Barthel Index (BI), FMA Scale and ARAT scores of the patients in both the ST and OT groups compared to pre-treatment. While there was a statistically significant difference in the comparison of the FMA Scale and ARAT scores between the groups after treatment, there was no significant difference between the groups in the BI scores. In a prospective randomized controlled study carried out by Rabadi et al.[23] with 30 acute stroke patients, the study patients were divided into 3 groups. The 1st group received ergotherapy training, 2nd group nonresistant continuous arm ergometry, and 3rd group robot-assisted therapy. In addition, standard rehabilitation treatment was applied to all groups. The study results yielded no statistically significant difference in the Functional Independence Measure (FIM) scale, FMA scale, ARAT, and MAS scores. Ultimately, robotic rehabilitation and arm ergometry appeared not to show

superiority to OT in improving upper extremity motor functions in acute stroke patients. In a randomized controlled study by Alsubiheen et al.[6] aimed to investigate the effects of 6 week in two 1.5 hours sessions/week task-oriented activities of daily living training on upper limb functions, activities of daily living (ADL), and quality of life (QoL) in chronic stroke patients. It has been shown that eight-week training has a positive effect on upper extremity functions and coarse dexterity and OT is effective in improving ADL and QoL in chronic stroke patients. In a randomized study by Almhdawi et al.[24] in which they evaluated the functional and impairment effects of the OT approach on the upper extremity after stroke, they showed that 3 hours/week for 6 weeks provided clinically significant functional improvements. In a study of 138 hemiplegic patients, Gilbertson et al.[25] compared OT with ST. BI was found to be significantly higher in the OT group at 6 months. Narayan et al.[26] evaluated 103 stroke patients by separating them into two groups. The first group received one hour of OT for meaningful tasks for four weeks, and the second group standard rehabilitation therapy during the same period. The patients were assessed with ARAT, FMA Scale, Wolf Motor Function Test, and Motor Activity Diary-28 at initial, at the 4th and 8th weeks of the treatment. Finally, it was revealed that OT provided statistically and clinically significant improvements in stroke patients' upper extremity motor recovery. In a study of Ayna et al.[27] patients with hemiplegia were assigned into two groups, conventional therapy (five days in a week, for four weeks) and occupational therapy in the content of repetitive task specific training (an hour once in a day, five days in a week, for four weeks) were performed for group 1, only conventional therapy was performed for group 2. There was not a significant statistical difference between two group's outcome parameters. While there was statistically significant improvements for upper extremity Brunstromm grade and emotional reactions subtitle of Nottingham Health Profile (NHP) in group 1, there were no significant improvements in group 2. In our study, OT was applied three times a week for 40 extremity dexterity. While the increase in FIM, FMA and ARAT was significant after treatment in both groups, the increase in the OT group was higher when compared to ST. The results of our study show that both ST and OT are effective in stroke rehabilitation. In addition, it has been clearly proven that more effective results are obtained in upper extremity functions with OT added to ST.

Limitations

Our study has some limitations. Most importantly, we did not classify stroke patients as acute, subacute and chronic stroke. Other limitations are that the small number of subjects, long-term efficacy was not evaluated and it was a single-center study. The efficacy of both ST and OT may not be standardized and may not be well documented depending on the patient-oriented natures of the rehabilitative programs.

CONCLUSION

OT is a part of medical rehabilitation therapy aimed at restoring, strengthening and increasing the person's performance in specified activities and tasks in order to improve health, reduce and correct pathology. OT shortens the length of hospital stay, increases activities of daily living, and increases the level of independence in stroke patients. The optimal dose, timing and treatment protocol for OT are entirely unclear. In this regard, we believe that we will contribute to the literature with our results regarding the duration of OT treatment in stroke patients. Multicenter studies with a larger number of patients will be more useful in determining the appropriate protocol of OT.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Hitit University Clinical Researches Ethics Committee (Date: 24.05.2023, Decision No: 2023-67).

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Roy-O'Reilly M, McCullough LD. Age and sex are critical factors in ischemic stroke pathology. *Endocrinology.* 2018;159(8):3120-31. doi. 10.1210/en.2018-00465
2. Deb P, Sharma S, Hassan KM. Pathophysiologic mechanisms of acute ischemic stroke: An overview with emphasis on therapeutic significance beyond thrombolysis. *Pathophysiology*. 2010;17(3):197-218. doi. 10.1016/j.pathophys.2009.12.001
3. Potter TB, Tannous J, Vahidy FS. A contemporary review of epidemiology, risk factors, etiology, and outcomes of premature stroke. *Curr Atheroscler Rep.* 2022;24(12):939–948. doi.10.1007/s11883-022-01067-x
4. Aydilek M, Yasar MF, Yaksi E. The effect of occupational therapy on upper extremity function and daily life activities in stroke patients. *J PMR Sci.* 2022;25(1):27–33. doi.10.31609/jpmrs.2021-83304
5. Li N, Yang T, Yu P, et al. Bio-inspired upper limb soft exoskeleton to reduce stroke-induced complications. *Bioinspir Biomim.* 2018;24(13):066001. doi. 10.1088/1748-3190/aad8d4

6. Alsubiheen AM, Choi W, Yu W, Lee H. The effect of task-oriented activities training on upper-limb function, daily activities, and quality of life in chronic stroke patients: a randomized controlled trial. *Int J Environ Res Public Health.* 2022;19(21):14125. doi. 10.3390/ijerph192114125
7. Nijland RH, Van Wegen EE, Harmeling-van der Wel BC, Kwakkel G. Presence of finger extension and shoulder abduction within 72 hours after stroke predicts functional recovery: early prediction of functional outcome after stroke: the EPOS cohort study. *Stroke.* 2010;41(4):745–750. doi. 10.1161/STROKEAHA.109.572065
8. Triccas LT, Kennedy N, Smith T, Pomeroy V. Predictors of upper limb spasticity after stroke? A systematic review and meta-analysis. *Physiotherapy.* 2019;105(2):163–173. doi. 10.1016/j.physio.2019.01.004
9. Lindgren A, Maguire J. Stroke recovery genetics. *Stroke.* 2016;47(9):2427–2434. doi:10.1161/STROKEAHA.116.010648
10. Wen X, Li L, Li X, et al. Therapeutic role of additional mirror therapy on the recovery of upper extremity motor function after stroke: a single-blind, randomized controlled trial. *Neural Plast.* 2022; 2022: 8966920. doi. 10.1155/2022/8966920
11. Wang Y, Li X, Sun C, Xu, R. Effectiveness of kinesiology taping on the functions of upper limbs in patients with stroke: a meta-analysis of randomized trial. *Neurological Sci.* 2022; 43(7):4145-4156. doi. 10.1007/s10072-022-06010-1
12. Yamakawa S, Nagayama H, Tomori K, Ikeda K, Niimi A. Effectiveness of active occupational therapy in patients with acute stroke: A propensity score-weighted retrospective study. *Front Rehabil Sci.* 2022;3:1045231. doi. 10.3389/fresc.2022.1045231
13. Bennett S, Laver K, Clemson L. Progressing knowledge translation in occupational therapy. *Aust Occup Therapy J.* 2018;65(2):156-160. doi. 10.1111/1440-1630.12473
14. Lindsay MP, Norrving B, Sacco RL, et al. World stroke organization (WSO): global stroke fact sheet 2019. *Int J Stroke.* 2019;14(8):806–817. doi. 10.1177/1747493019881353
15. Santisteban L, Térémetz M, Bleton JP, Baron JC, Maier MA, Lindberg PG. Upper limb outcome measures used in stroke rehabilitation studies: a systematic literature review. *PLoS ONE.* 2016;11(5) :e0154792. doi. 10.1371/journal.pone.0154792
16. Gosman-Hedstrom G, Svensson E. Parallel reliability of the functional independence measure and the Barthel index ADLIndex. *Psychiatry.* 2009;22(16):702-715. doi. 10.1080/0963828005019 1972
17. Gladstone DJ, Danells CJ, Black SE. The Fugl-Meyer assessment of motor recovery after stroke: a critical review of its measurement properties. *Neurorehabil Neural Repair.* 2002; 16(3):232-240. doi. 10.1177/154596802401105171
18. McDonnell M. Action research arm test. *Aust J Physiother.* 2008;54(3):220-221. doi. 10.1016/S0004 - 9514(08)70034-5
19. Avan A, Digaleh H, Di Napoli M, et al. Socioeconomic status and stroke incidence, prevalence, mortality, and worldwide burden: an ecological analysis from the Global Burden of Disease Study 2017. *BMC Medicine.* 2019;17(1):1-30. doi. 10.1186/s12916-019-1397-3
20. Yang C, Pan Y. Risk factors of dysphagia in patients with ischemic stroke: A meta-analysis and systematic review. *Plos ONE.* 2022;17(6):0270096. doi. 10.1371/journal.pone.0270096
21. Topçuoğlu MA. Türkiye'de inme epidemiyolojisi ve yakın gelecek projeksiyonu: küresel hastalık yükü çalışması Türkiye verilerinin analizi. *Turk J Neurol.* 2022; 28: 200-211. doi. 10.4274/tnd. 2022.31384
22. Adams H, Adams R, Del Zoppo G, Goldstein LB. Guidelines for the early management of patients with ischemic stroke: 2005 guidelines update a scientific statement from the Stroke Council of the American Heart Association/American Stroke Association. *Stroke.* 2005;36:916-923. doi. 10.1161 /01.STR.0000163257.66207.2d
23. Rabadi MH, Galgano M, Lynch D, Akerman M, Lesser M, Volpe BT. A pilot study of activity-based therapy in the arm motor recovery post stroke: a randomized controlled trial. *Clin Rehabil.* 2008;22: 1071-82. doi. 10.1177/0269215508095358
24. Almhdawi KA, Mathiowetz VG, White M, delMas RC. Efficacy of occupational therapy task-oriented approach in upper extremity post-stroke rehabilitation. *Occup Therapy Int.* 2016;23(4): 444-456. doi. 10.1002/oti.1447
25. Gilbertson L, Langhorne P, Walker A, Allen A, Allen A, Murray GD. Domiciliary occupational therapy for patients with stroke discharged from hospital: randomised controlled trial. *BMJ.* 2000; 320:603-606. doi. 10.1136/bmj.320.7235.603
26. Narayan AK, Verma R, Garg RK, Sharma VP, Agarwal M, Aggarwal GG. Meaningful task-specific training (MTST) for stroke rehabilitation: a randomized controlled trial. *Top Stroke Rehabil.* 2012; 19(3):193-211. doi. 10.1310/tsr1903-193
27. Ayna AB, Yıldırım MA, Önes K. Hemiplejik hastalarda iş uğraşı tedavisi etkinliği [Effectiveness of occupational theraphy in hemiplegic patients]. *Pamukkale Tıp Derg.* 2019;12:23-32. doi. 10.31362/ patd.407800